

# PATENT ABSTRACTS OF JAPAN

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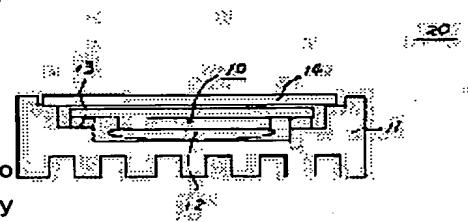
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### (54) REFLECTION TYPE LIQUID CRYSTAL DISPLAY ELEMENT AND MANUFACTURING METHOD THEREFOR

#### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a high quality reflection type liquid crystal display element free from the fear of the image quality degradation due to external mechanical stress and thermal stress.

**SOLUTION:** In the reflection type liquid crystal display element 20 consisting of a reflection type liquid crystal display cell 10 consisting of a silicon wafer substrate 4, a transparent substrate 2 and a liquid crystal layer 5 sealed therebetween and a plate 11 for cooling and fixing the reflection type liquid crystal cell 10, the plate 11 for cooling and fixing and the reflection type liquid crystal cell 10 have a gap of 50-500  $\mu$ m therebetween and are fixed to each other by a silicone gel agent 12 having  $\geq 0.5$  W/m.K thermal conductivity and an adhesive 13 having 50-500  $\mu$ m thickness.



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**CLAIMS**

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**[Claim(s)]**

**[Claim 1]** It is the reflective mold liquid crystal display component which consists of a plate which cools and fixes the reflective mold liquid crystal display cel which consists of a liquid crystal layer by which the closure was carried out between a silicon wafer substrate, a transparency substrate, and said both substrates, and said reflective mold liquid crystal display cel. The clearance between the plate for said cooling and immobilization and said reflective mold liquid crystal display cel by 50 micrometers – 500 micrometers And the reflective mold liquid crystal display component characterized by having fixed, respectively with the silicone gel which has the thermal conductivity of 0.5 or more W/m·k, and adhesives with a thickness of 50 micrometers – 500 micrometers.

**[Claim 2]** The reflective mold liquid crystal display cel which consists of a liquid crystal layer by which the closure was carried out between a silicon wafer substrate, a transparency substrate, and said both substrates, It is the manufacture approach of the reflective mold liquid crystal display component which consists of a plate which cools and fixes said reflective mold liquid crystal display cel. The plate which has fin structure and positioning structure on the plinth which has positioning structure is positioned. The process which applies adhesives to the part which makes silicone gel with \*\* the part in contact with the silicon wafer substrate rear face of said reflective mold liquid crystal display cel on said plate, and receives the transparency substrate on said plate, The process which keeps the clearance between said reflective mold liquid crystal display cels and plates at 50 micrometers – 500 micrometers with a manipulator in each of said silicone gel spreading section and adhesives \*\*\*\*\*. The manufacture approach of the reflective mold liquid crystal display component characterized by consisting of a process which stiffens said adhesives, and a process which makes said silicone gel fix.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**[0001]**

**[Field of the Invention]** Especially this invention relates to the structure and its manufacture approach of a reflective mold liquid crystal display component about the reflective mold liquid crystal display

component as radical management articles, such as a projector and Projection TV.

[0002]

[Description of the Prior Art] The liquid crystal display component as a display device of a projector or Projection TV has been used widely. The reflective mold liquid crystal display component called the LCOS (Liquid Crystal On Silicon) component which the silicon substrate which allotted the CMOS transistor drive circuit for supplying an electrical potential difference, and the transparency substrate in which the common electrode was formed counter to the reflector and it which have been arranged especially in the shape of a matrix, was stuck on them in recent years, and pinched liquid crystal in the meantime has attracted attention in the height of the display image quality.

[0003] Such a reflective mold liquid crystal display component fixes to the circuit board the liquid crystal display cel which pinched the liquid crystal layer with said silicon substrate and transparency substrate, and carries out wiring processing, or is contained and constituted by the package of metal or the product made of resin with the flexible printed circuit board (FPC).

[0004] Although a reflective mold liquid crystal display component which was described above is carried in the set of a projector or Projection TV Since the light source turns into a heat source in that case, the temperature in said TV set rises, or in case said reflective mold liquid crystal display component reflects an image in response to a powerful light of two or more [ several W //cm ] from the light source, the absorption of light happens and the temperature of said reflective mold liquid crystal display component itself rises.

[0005] Therefore, if external stress is applied to the glass substrate of said reflective mold liquid crystal display component or thermal stress requires said reflective mold liquid crystal display component for it in response to the circuit board or the force from a package, a birefringence will be discovered into the glass ingredient itself which constitutes a glass substrate. Since the liquid crystal layer of said reflective mold liquid crystal display component applies the form birefringence of liquid-crystal from the first and an image is produced, the manifestation of the birefringence of a glass ingredient is superimposed on the birefringence of this liquid crystal layer, and makes the quality of an image deteriorate.

[0006] Moreover, if thermal stress is applied to said reflective mold liquid crystal display component too much or temperature of a component own [ this ] rises too much, according to the coefficient-of-thermal-expansion difference between said silicon substrates and said transparency substrates, the cel gap of a liquid crystal layer will change and this will also lead to degradation of image quality. Therefore, to a reflective mold liquid crystal display component, even if the light from the light source hits, it becomes an important technique for how it is made for the stress from the outside not to be applied to this component to maintain good image quality from the difference in coefficient of thermal expansion with how heat is radiated and said exterior of a reflective mold liquid crystal display component.

[0007] As a conventional example using such a technique, (1).JP,10-20234,A, a (2) \*\* table 2001-No. 500633 official report, and (3) JP,11-64860,A can be mentioned, for example. Hereafter, it outlines per each technical contents.

[0008] The reflective mold liquid crystal display component 30 concerning JP,10-20234,A of (1) As shown in the explanatory view of drawing 6 , to the silicon (IC) substrate 33 and the circuit board 31 which fixes the reflective mold liquid crystal panel 36 which consists of transparency substrate 34 grade It is the configuration which the hole 32 narrower than the first direction width of face of said transparency substrate 34 was formed, said IC substrate 33 was installed in said hole 32, and the both ends of the first direction of said transparency substrate 34 have fixed with adhesives 35 between said circuit boards 31 more greatly than said IC substrate 33. In addition, said adhesives 35 are the structure where it is wiring between said IC substrates 33 and said circuit boards 31 using the thing of a conductive ultraviolet curing mold. Moreover, the expedient top of explanation and the liquid crystal layer are not illustrated.

[0009] As the reflective mold liquid crystal display component 40 concerning the \*\* table 2001-No. 500633 official report of (2) is shown in the explanatory view of drawing 7 , a window part 42 is formed in the 1st transparent substrate 43 and the circuit board 41 for fixing the reflective mold liquid crystal panel 45 which consists of active-matrix component 44 grade, and the active-matrix component 44

which constitutes said some of reflective mold liquid crystal panels 45 is constituted so that it may sink into the heat dissipation gel ingredient 46 through this window part 42. Said gel ingredients 46 are paid to in the crevice of the base material 47. This base material 47 is structure which is supporting said circuit board 41. In addition, the expedient top of explanation and the liquid crystal layer are not illustrated.

[0010] The reflective mold liquid crystal display component 50 concerning JP,11-64860,A of (3) As shown in the explanatory view of drawing 8 , to the tooth-back side of the 1st substrate 52 and the reflective mold liquid crystal panel 54 which consists of the 2nd substrate 53 grade attached in a package body 51 The metal heat sink 55 is the configuration of being installed where four sides are laid underground, and having made the heat dissipation sheet 56 which has elasticity comparatively intervening between said reflective mold liquid crystal panels 54 and said metal heat sinks 55. And said package body 51 has mold cavity structure sealed with the metal heat sink 55 prepared in the above mentioned reflective mold liquid crystal panel 54 tooth-back side, and the front glass plate 57. In addition, the expedient top of explanation and the liquid crystal layer are not illustrated.

[0011]

[Problem(s) to be Solved by the Invention] By the way, in the reflective mold liquid crystal display component which is a radical management article for projection displays, a component part price for the need of saying that degradation of image display quality does not occur with mechanical stress and thermal stress to respond to the request of low-pricing for which the liquid crystal display component is asked from the first in recent years, and reduction-ization of component part mark are needed.

[0012] However, in the case of the reflective mold liquid crystal display component 30 concerning JP,10-20234,A of the above mentioned (1) The configuration which there is no part in contact with the tooth back of the reflective mold liquid crystal panel 36, and has fixed to the circuit board 31 directly through adhesives 35 sake, While it is hard to receive external machine stress, the heat dissipation effectiveness from the reflective mold liquid crystal panel 36 with the quantity of light which it was bad and was moreover irradiated by said reflective mold liquid crystal panel 36 The temperature of this reflective mold liquid crystal panel 36 self rises, and it has the technical problem that the cel gap of the liquid crystal layer which is not illustrated according to the coefficient-of-thermal-expansion difference between each component part tends to change.

[0013] Moreover, in the case of the reflective mold liquid crystal display component 40 concerning the \*\* table 2001-No. 500633 official report of (2) Although heat dissipation effectiveness is good, and it has the good field of being hard to receive external machine stress, for the structure which is sinking the 2nd substrate 44 which constitutes some reflective mold liquid crystal panels 45 in the heat dissipation gel 46 prepared in the crevice of the base material 47 since heat dissipation gel 46 has elasticity Since the adhesion support between the base material 47, the circuit board 41, and three configuration members of the reflective mold liquid crystal panel 45 is needed, it has the technical problem that productivity is bad.

[0014] furthermore, in the case of the reflective mold liquid crystal display component 50 concerning JP,11-64860,A of (3), heat dissipation effectiveness be gather through the heat dissipation sheet 57 between the liquid crystal panel 55 and the metal heat sink 56, but a package configuration be complicated, moreover the inside of a mold cavity must be keep airtight, productivity be bad and the technical problem that it can be hard to attain reduction-ization of the components price for which the above mentioned liquid crystal display component be ask occur.

[0015] By having been made in view of this technical problem , and having constituted so that a reflective mold liquid crystal display cel might be supported only with the plate which have the function of cooling and immobilization , this invention also solve the trouble of image quality degradation by external machine stress and thermal stress , and the trouble about productivity to coincidence , and aim at offer the reflective mold liquid crystal display component which have this configuration . Moreover, it aims at offering the new manufacture approach of a reflective mold liquid crystal display component of having this configuration collectively.

[0016]

[Means for Solving the Problem] Invention which this invention is made in order to attain the above mentioned purpose, and relates to claim 1 It is the reflective mold liquid crystal display component 20 which consists of a plate 11 which cools and fixes the reflective mold liquid crystal display cel 10 which consists of a liquid crystal layer 5 by which the closure was carried out between the silicon wafer substrate 4, the transparency substrate 2, and said both substrates, and said reflective mold liquid crystal display cel 10. Said cooling And it is characterized by having fixed, respectively with the silicone gel 12 which the clearance between the plate 11 for immobilization and the reflective mold liquid crystal display cel 10 is 50 micrometers – 500 micrometers, and has the thermal conductivity 0.5W/m and more than k, and the adhesives 13 with a thickness of 50 micrometers – 500 micrometers.

[0017] The reflective mold liquid crystal display cel 10 which consists of a liquid crystal layer 5 by which the closure of the invention concerning claim 2 was carried out between the silicon wafer substrate 4, the transparency substrate 2, and said both substrates, It is the manufacture approach of the reflective mold liquid crystal display component 20 which consists of a plate 11 which cools and fixes said reflective mold liquid crystal display cel 10. The plate 11 which has the fin structures 11a-11n and the positioning structure 181,182 on the plinth 21 which has the positioning structures 22 and 23 is positioned. The process which applies adhesives 13 to the part which makes silicone gel 12 with \*\* the part in contact with silicon wafer substrate 4 rear face of said reflective mold liquid crystal display cel 10 on said plate 11, and receives the transparency substrate 2 on said plate 11, The process which keeps the clearance between said reflective mold liquid crystal display cels 10 and plates 11 at 50 micrometers – 500 micrometers with a manipulator 26 in each of said silicone gel spreading section and adhesives \*\*\*\*\*, It is characterized by consisting of a process which stiffens said adhesives 13, and a process which makes said silicone gel 12 fix.

[0018]

[Embodiment of the Invention] Hereafter, one suitable example of this invention is explained based on an accompanying drawing. In addition, since the example described below is a suitable example of this invention, desirable various limitation is attached technically, but especially the range of this invention is not restricted to these modes, as long as there is no publication of the purport which limits this invention in the following explanation.

[0019] The decomposition perspective view of one example of the reflective mold liquid crystal display cel which is the principal part of the reflective mold liquid crystal display component which drawing 1 requires for this example, and drawing 2 The explanatory view of the reflective mold liquid crystal display component which the configuration explanatory view of drawing 1 and drawing 3 require for this invention, and drawing 4 It is the explanatory view of the plate which is the component of the reflective mold liquid crystal display component concerning this invention, and (a) is process drawing showing the manufacture approach of the reflective mold liquid crystal display component which the top view and (b) require for the side elevation, and drawing 5 requires for this invention.

[0020] As shown in drawing 1 , the reflective mold liquid crystal display cel 10 which becomes this example has the structure where the transparent electrode 1, the transparency substrate 2 with which the antireflection film 8 was given, and the silicon wafer (IC) substrate 4 to which the pixel electrode 3, the CMOS transistor for a drive which is not illustrated are given according to the semi-conductor process were \*\*\*\*\* (ed).

[0021] Drawing 2 is the configuration explanatory view showing the completion condition of the reflective mold liquid crystal display cel 10 of drawing 1 . The liquid crystal layer 5 was formed between the two above mentioned substrates 2 and 4, and these two substrates 2 and 4 have fixed with the seal adhesives 7 which mixed the spacer 6 which determines the cel gap of the liquid crystal layer 5. The orientation film which is not illustrated is given to the contact surface with two substrates 2 and 4 of the liquid crystal layer 5. In the case of this example, a transparent electrode 1 gives the oxidation silicon film as the ITO (Indium Tin Oxide) film and orientation film, using #by Corning, Inc. 1737 glass substrate as a transparency substrate 2.

[0022] Moreover, the nematic liquid crystal of n mold was used as liquid crystal which constitutes the liquid crystal layer 5. As seal adhesives 7, the YAKUSHI Chemicals SW-3.2D1 spacer ball was mixed in

WR series [ by Kyoritsu Chemical& Co., Ltd. ] main sealing compound, and it fixed with UV irradiation and heating. Thus, the structure which shows the produced reflective mold liquid crystal display cel 10 in drawing 3 and drawing 4 as an approach of cooling at the time of actuation was adopted.

[0023] That is, in drawing 3 and drawing 4, on the plate 11 which has cooling fins 11a-11n, silicone gel 12 is carried out with \*\*, and the UV adhesives 13 are applied to the contact surface of the glass substrate 2 of said reflective mold liquid crystal display cel 10, and a plate 11. the thickness after hardening of silicone gel 12 and the UV adhesives 13 — 50 micrometers — 500 micrometers — it is — desirable — It is 50 micrometers — 300 micrometers.

[0024] The thermal conductivity of silicone gel 12 has 0.5 or more desirable W/m·k, and the high temperature conductivity silicone gel by GE Toshiba Silicones Co., Ltd. and the Dow Corning Toray Silicone silicone gel SE series for heat dissipation are suitable for it. Here, the high temperature conductivity silicone gel TSE series by GE Toshiba Silicones Co., Ltd. which has the thermal conductivity of 0.6W/m and k was used.

[0025] Since they are the things holding positioning between said reflective mold liquid crystal display cels 10 and plates 11 until said silicone gel 12 hardens the UV adhesives 13 at the time of manufacture, if they are ingredients which hold positioning and do not give mechanical stress to said reflective mold liquid crystal display cel 10 and which have elasticity comparatively, they will not be limited to the UV adhesives 13. Here, ultraviolet-rays hardenability resin KEMISHIRU made from KEMITEKKU was used.

[0026] Since heat is radiated through silicone gel 12 as a plate 11 in the heating value of said reflective mold liquid crystal display cel 10, the ingredient which has thermal conductivity higher than silicone gel 12 is desirable. Here, aluminum material was used. Since the thermal conductivity of aluminum is about 238 W/m·k, sufficient heat dissipation effectiveness is acquired. In addition, 14 is aperture material (aperture).

[0027] Moreover, in drawing 4, the pars intermedia in which the UV adhesives 13 which the bottom surface part in which the silicone gel 12 which 15 described above is formed, and 16 described above are formed, and 17 are the top-face sections in which the above mentioned aperture 14 is formed. The locating hole where the gage pins 22 and 23 which 181 and 182 mention later are inserted, and 191-194 are the screw holes for fixing to the optic of projector optical system etc. the reflective mold liquid crystal display component 20 mentioned later.

[0028] Next, the experimental result of the reflective mold liquid crystal display component 20 which becomes this example formed by doing in this way is explained. First, between the glass substrate 2 of said reflective mold liquid crystal display cel 10, and a plate 11 After applying four UV adhesives 13 by the thickness of 50 micrometers or more, these UV adhesives 13 are stiffened by UV irradiation. Between the silicon wafer (IC) substrate 4 and a plate 11 When silicone gel 12 was not minded (air space: thermal conductivity 0.02 W/m·k), the nonuniformity by the birefringence manifestation of glass arose on the image under 70-degree C hot environments.

[0029] On the other hand, like the above, between the glass substrate 2 of said reflective mold liquid crystal display cel 10, and a plate 11 After applying four UV adhesives 13 by the thickness of 50 micrometers or more, these UV adhesives 13 are stiffened by UV irradiation. And when silicone gel 12 was made to intervene by the thickness of 50 micrometers or more between the silicon wafer (IC) substrate 4 and a plate 11, even if it was under [ of 70 degrees C ] hot environments, the nonuniformity on an image was not observed at all, and did not generate cel gap change, either. Especially, in the thickness of 50 micrometers — 300 micrometers, it was good. Furthermore, also when carried in the projector optical system of 1500ANSI lumens, the nonuniformity on an image or degradation of display image quality did not take place at all.

[0030] In addition, between the glass substrate 2 of said reflective mold liquid crystal display cel 10, and a plate 11 After applying four UV adhesives 13 by the thickness of 20 micrometers, these UV adhesives 13 are stiffened by UV irradiation. And when silicone gel 12 was made to intervene by the thickness of 20 micrometers between the silicon wafer (IC) substrate 4 and a plate 11, the nonuniformity by the birefringence manifestation of glass arose on the image under the room temperature environment (i.e., an initial state). From this, the thickness of silicone gel 12 and the UV adhesives 13 can understand that

50 micrometers or more are required.

[0031] The thickness of the above mentioned silicone gel 12 and the above mentioned UV adhesives 13 is decided in view of the following three points. Namely, if (1) thermal resistance is taken into consideration, since it will become large in proportion to thickness If 500 micrometers is made into an upper limit, the good heat dissipation effectiveness will be acquired. (2) Absorb with [ of the display flatness ] a rose in consideration of possibility of being generated with a rose (about 200 micrometers), in the production process (in the case of extrusion molding) of the plate 11 which is mentioned later to the display flatness of the field which receives said reflective mold liquid crystal display cel 10. (3) By setting the upper limit of thickness as 500 micrometers, the reflective mold liquid crystal display cel 10 is stopped by the location change in tolerance, even if the force joins the field inboard.

[0032] In addition, a heat dissipation property gets worse, so that and it will become thick, if it becomes thick since thermal resistance is proportional to the thickness of an ingredient. Moreover, a good result is not obtained that the physical relationship of aperture and the reflective mold liquid crystal display component 20 tends to shift to such an external load that the location change to the load of the direction of a flat surface will become thick if it becomes thick since it is proportional to the thickness of an ingredient too.

[0033] That is, the reflective mold liquid crystal display component 20 which becomes this example is set in a projector or a projection TV set by having configurated silicone gel 12 and the UV adhesives 13 so that it might start. Also by the temperature rise by a powerful optical exposure and powerful it, the good reflective mold liquid crystal display component which does not have degradation in display image quality is obtained.

[0034] Next, the manufacture approach of the drawing 1 – drawing 5 , and reflective mold liquid crystal display component 20 which become this example mainly with reference to drawing 5 is explained. In addition, for a dispenser and 25, as for a manipulator and 27, in drawing 5 , a CCD camera and 26 are [ the plinth which has the locator pins 22 and 23 which 21 described above on the top face, and 24 / a UV irradiation light guide and 28 ] oven.

[0035] First, the plate 11 which has the tooling holes 181 and 182 first described above is inserted along with gage pins 22 and 23 from the upper part, and this plate 11 is fixed on a plinth 21 (a).

[0036] Next, silicone gel 12 is carried out with \*\* by the dispenser 24 on the plate 11 by which positioning immobilization was carried out on the plinth 21 in the receptacle side of the silicon wafer substrate 4 of said reflective mold liquid crystal display cel 10. Moreover, the ultraviolet curing mold adhesives 13 are applied to the receptacle side of the glass substrate 2 which is a transparency substrate by the dispenser 24 described above several places (b).

[0037] Next, while recognizing the location of tooling holes 181 and 182 established in the above mentioned plate 11 with CCD camera (sensor) 25, the image recognition of the pixel section design pattern 3 of said reflective mold liquid crystal display cel 10 is carried out, and the location which fixes said reflective mold liquid crystal display cel 10 on a plate 11 is detected (c).

[0038] Next, with a manipulator (maintenance arm) 26, said reflective mold liquid crystal display cel 10 is held in a flat-surface location and a perpendicular direction location predetermined in a plate 11 top, and the base of the silicon wafer substrate 4 of said reflective mold liquid crystal display cel 10 and a page [ of a plate / 11th ] clearance are kept at 50 micrometers – 500 micrometers after an appropriate time.

[0039] Next, ultraviolet rays are irradiated by the light guide 27 for UV irradiation, and the UV adhesives 13 which are between the glass substrate 2 of said reflective mold liquid crystal display cel 10 and a plate 11 where this clearance is maintained are made to harden this. At this time, the location on the plate 11 of said reflective mold liquid crystal display cel 10 is fixed (d).

[0040] Next, CCD camera 25 performs pattern recognition of aperture 14 again, each of a relative position with the location of tooling holes 181 and 182 established in the plate 11 which detected the point is determined, and the aperture material 14 is held by the position in manipulator 26 grade (e).

[0041] After an appropriate time, UV adhesives are applied by the above mentioned dispenser 24 near the contact section of the aperture 14 and the plate 11 which were held in the desired location (f).

[0042] Next, UV adhesives which irradiated ultraviolet rays by the light guide 27 for UV irradiation, and

were described above in UV adhesives carried out with \*\* are stiffened (g).

[0043] Since the process (f) which applies UV adhesives near the contact section of the above mentioned aperture 14 and the above mentioned plate 11, and the process (g) which stiffens UV adhesives which irradiated ultraviolet rays by the light guide 27 for UV irradiation, and were described above in UV adhesives carried out with \*\* desire a quick cure rate in UV ultraviolet rays from a viewpoint of productivity, if it is adhesives with a quick cure rate, it will not be limited to UV adhesives. Moreover, the sponge for protection against dust which is not illustrated may be beforehand given to the aperture material 14.

[0044] According to the above process, said reflective mold liquid crystal display cel 10 and aperture 14 heat the thing in the condition of having fixed on the plate 11, in oven 28, and promote hardening of silicone gel 12 (h). Heating conditions have 30 minutes – about 1 desirable hour at 100 degrees C – 120 degrees C.

[0045] By performing the above mentioned time amount heating, the reflective mold liquid crystal display component 20 is completed (i).

[0046] When aperture 14 is unnecessary among the above processes, the process (g) which stiffens the UV adhesives 13 which irradiated ultraviolet rays by the light guide 27 for UV irradiation, and were described above in the UV adhesives 13 carried out with [ which holds the above mentioned aperture 14 by the position in manipulator 26 grade ] process (e) – \*\* can be skipped.

[0047] Moreover, the process which fixes with the UV adhesives 13, holding the flexible printed circuit board (FPC) which is prepared in a reflective mold liquid crystal display cel, and which is not illustrated with a clearance in the above mentioned manufacture approach from said plate 11, By adding the process which installs the aperture 14 which passes incident light and a display image on said plate 11, and fixes with UV adhesives, this seed reflective mold liquid crystal display component stabilized more is obtained. In addition, these processes are performed between processes (d) (e) –, the claim in that case is as follows, and this invention also includes these contents.

[0048] It is the manufacture approach of the reflective mold liquid crystal display component which consists of a plate which cools and fixes the reflective mold liquid crystal display cel which consists of a liquid crystal layer by which the closure was carried out between a silicon wafer substrate, a transparency substrate, and said both substrates, and said reflective mold liquid crystal display cel. The plate which has fin structure and positioning structure on the plinth which has positioning structure is positioned. The process which applies adhesives to the part which makes silicone gel with \*\* the part in contact with the silicon wafer substrate rear face of said reflective mold liquid crystal display cel on said plate, and receives the transparency substrate on said plate, The process which keeps the clearance between said reflective mold liquid crystal display cels and said plates at 50 micrometers – 500 micrometers with a manipulator in each of the silicone gel spreading section and adhesives \*\*\*\*\*. The process which stiffens said adhesives, and the process which fixes with said adhesives, holding the flexible printed circuit board prepared in said reflective mold liquid crystal display cel with said plate and clearance; The manufacture approach of the reflective mold liquid crystal display component characterized by consisting of a process which installs the aperture material which passes incident light and a display image on said plate, and fixes with said adhesives, and a process which makes said silicone gel fix.

[0049]

[Effect of the Invention] Invention concerning claim 1 is a reflective mold liquid crystal display component which consists of a plate which cools and fixes the reflective mold liquid crystal display cel which consists of a liquid crystal layer by which the closure was carried out between a silicon wafer substrate, a transparency substrate, and said both substrates, and said reflective mold liquid crystal display cel. Since it has fixed, respectively with the silicone gel which is the thickness whose clearance between the plate for said cooling and immobilization and a reflective mold liquid crystal display cel is 50 micrometers – 500 micrometers, and has the thermal conductivity of 0.5 or more W/m·k, and adhesives with a thickness of 50 micrometers – 500 micrometers Since the nonuniformity on an image which is produced by the manifestation of the birefringence produced when change of a cel gap is not seen under

hot environments and stress is usually applied to a glass substrate is not generated, either. When it uses for a projector and Projection TV, the effectiveness that good display image quality can be maintained is acquired.

[0050] Moreover, in claim 1, since the reflective mold liquid crystal display cel is supported through silicone gel and adhesives only on the plate which has the function of cooling and immobilization, there are few components mark, and it ends, therefore productivity is very good, and a cheap and quality reflective mold liquid crystal display component is obtained.

[0051] Moreover, in claim 1, since silicone gel has the thermal conductivity of 0.5 or more W/m·k, and the thickness of 50 micrometers – 500 micrometers, there is no fear of image quality degradation by external machine stress and thermal stress, and a quality reflective mold liquid crystal display component is obtained.

[0052] Furthermore, in claim 1, since silicone gel has the thermal conductivity of 0.5 or more W/m·k, and the thickness of 50 micrometers – 500 micrometers as mentioned above, the heat dissipation effectiveness from a reflective mold liquid crystal display cel is good, there is no fear of image quality degradation by the external temperature rise, and a quality reflective mold liquid crystal display component is obtained.

[0053] The reflective mold liquid crystal display cel which consists of a liquid crystal layer by which the closure of the invention concerning claim 2 was carried out between a silicon wafer substrate, a transparency substrate, and said both substrates. It is the manufacture approach of the reflective mold liquid crystal display component which consists of a plate which cools and fixes said reflective mold liquid crystal display cel. The plate which has fin structure and positioning structure on the plinth which has positioning structure is positioned. The process which applies adhesives to the part which makes silicone gel with \*\* the part in contact with the silicon wafer substrate rear face of said reflective mold liquid crystal display cel on said plate, and receives the transparency substrate on said plate. The process which keeps the clearance between said reflective mold liquid crystal display cels and plates at 50 micrometers – 500 micrometers with a manipulator in each of said silicone gel spreading section and adhesives \*\*\*\*\*. What consists of a process which stiffens said adhesives, and a process which makes said silicone gel fix. Namely, silicone gel and adhesives are applied on the positioned plate. Since it is the manufacture approach of making silicone gel fixing with said reflective mold liquid crystal display cel held, at the time of manufacture Assembly components can take the simple method of construction of accumulating use components from the bottom, therefore the design and automation of assembly equipment at the time of manufacture are easy for them, and they can maintain high productivity.

[0054] Moreover, in claim 2, since structure of a plate of having fin structure and positioning structure was made simple and knockout molding of a metal or resin is attained on the occasion of manufacture of plate components, low-pricing of plate components is attained, as a result it can contribute to low-pricing of a reflective mold liquid crystal display component.

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DESCRIPTION OF DRAWINGS

**[Brief Description of the Drawings]**

**[Drawing 1]** It is the decomposition perspective view of one example of the reflective mold liquid crystal display cel which is the principal part of the reflective mold liquid crystal display component concerning this invention.

**[Drawing 2]** It is the configuration explanatory view of drawing 1.

**[Drawing 3]** It is the explanatory view of the reflective mold liquid crystal display component concerning this invention.

**[Drawing 4]** It is the explanatory view of the plate which is the component of the reflective mold liquid crystal display component concerning this invention.

**[Drawing 5]** It is process drawing showing the manufacture approach of the reflective mold liquid crystal display component concerning this invention.

**[Drawing 6]** It is the explanatory view of the conventional reflective mold liquid crystal display component.

**[Drawing 7]** It is the explanatory view of the conventional reflective mold liquid crystal display component.

**[Drawing 8]** It is the explanatory view of the conventional reflective mold liquid crystal display component.

**[Description of Notations]**

1 Transparent Electrode

2 Transparency Substrate

3 Pixel Electrode

4 Silicon Wafer Substrate

5 Liquid Crystal Layer

6 Spacer

7 Seal Adhesives

8 Antireflection Film

9 Closure Section

10 Reflective Mold Liquid Crystal Display Cel

11 Plate

12 Silicone Gel

13 UV Adhesives

14 Aperture

15 Bottom Surface Part

16 Pars Intermedia

17 Top-Face Section

18 Locating Hole

19 Reflective Mold Liquid Crystal Display Component Fixed Hole

20 Reflective Mold Liquid Crystal Display Component

21 Standing Ways

22 Gage Pin

23 Gage Pin

24 Dispenser

25 CCD Camera

26 Manipulator

27 UV Irradiation Guide

28 Oven

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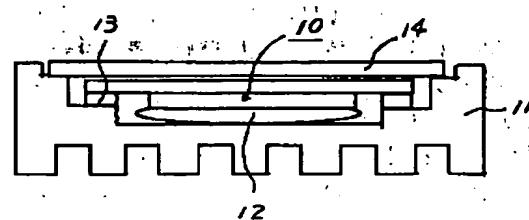
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(54)【発明の名称】 反射型液晶表示素子及びその製造方法

(57)【要約】

【課題】 外的な機械応力や熱応力による画像品質劣化のおそれがない、高品質な反射型液晶表示素子を提供する。

【解決手段】 シリコンウエハー基板4と透明基板2と前記両基板間に封止された液晶層5からなる反射型液晶表示セル10と前記反射型液晶表示セル10を冷却及び固定するプレート11とからなる反射型液晶表示素子20であって、前記冷却及び固定のためのプレート11と前記反射型液晶表示セル10との隙間が、 $50\text{ }\mu\text{m} \sim 500\text{ }\mu\text{m}$ で、かつ、 $0.5\text{ W/m}\cdot\text{k}$ 以上の熱伝導率を有するシリコーンゲル剤12及び $50\text{ }\mu\text{m} \sim 500\text{ }\mu\text{m}$ の厚さの接着剤13によってそれぞれ固着されている。



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## 【特許請求の範囲】

【請求項1】シリコンウェハー基板と透明基板と前記両基板間に封止された液晶層からなる反射型液晶表示セルと前記反射型液晶表示セルを冷却及び固定するプレートとからなる反射型液晶表示素子であって、前記冷却及び固定のためのプレートと前記反射型液晶表示セルとの隙間が、 $50\text{ }\mu\text{m} \sim 500\text{ }\mu\text{m}$ で、かつ、 $0.5\text{ W/m}\cdot\text{K}$ 以上の熱伝導率を有するシリコーンゲル剤及び $50\text{ }\mu\text{m} \sim 500\text{ }\mu\text{m}$ の厚さの接着剤によってそれぞれ固着されていることを特徴とする反射型液晶表示素子。

【請求項2】シリコンウェハー基板と透明基板と前記両基板間に封止された液晶層からなる反射型液晶表示セルと、前記反射型液晶表示セルを冷却及び固定するプレートとからなる反射型液晶表示素子の製造方法であって、位置決め構造を有する台座上に、<sup>1</sup>、<sup>2</sup>、<sup>3</sup>、<sup>4</sup>、<sup>5</sup>、<sup>6</sup>、<sup>7</sup>、<sup>8</sup>、<sup>9</sup>、<sup>10</sup>、<sup>11</sup>、<sup>12</sup>、<sup>13</sup>、<sup>14</sup>、<sup>15</sup>、<sup>16</sup>、<sup>17</sup>、<sup>18</sup>、<sup>19</sup>、<sup>20</sup>、<sup>21</sup>、<sup>22</sup>、<sup>23</sup>、<sup>24</sup>、<sup>25</sup>、<sup>26</sup>、<sup>27</sup>、<sup>28</sup>、<sup>29</sup>、<sup>30</sup>、<sup>31</sup>、<sup>32</sup>、<sup>33</sup>、<sup>34</sup>、<sup>35</sup>、<sup>36</sup>、<sup>37</sup>、<sup>38</sup>、<sup>39</sup>、<sup>40</sup>、<sup>41</sup>、<sup>42</sup>、<sup>43</sup>、<sup>44</sup>、<sup>45</sup>、<sup>46</sup>、<sup>47</sup>、<sup>48</sup>、<sup>49</sup>、<sup>50</sup>、<sup>51</sup>、<sup>52</sup>、<sup>53</sup>、<sup>54</sup>、<sup>55</sup>、<sup>56</sup>、<sup>57</sup>、<sup>58</sup>、<sup>59</sup>、<sup>60</sup>、<sup>61</sup>、<sup>62</sup>、<sup>63</sup>、<sup>64</sup>、<sup>65</sup>、<sup>66</sup>、<sup>67</sup>、<sup>68</sup>、<sup>69</sup>、<sup>70</sup>、<sup>71</sup>、<sup>72</sup>、<sup>73</sup>、<sup>74</sup>、<sup>75</sup>、<sup>76</sup>、<sup>77</sup>、<sup>78</sup>、<sup>79</sup>、<sup>80</sup>、<sup>81</sup>、<sup>82</sup>、<sup>83</sup>、<sup>84</sup>、<sup>85</sup>、<sup>86</sup>、<sup>87</sup>、<sup>88</sup>、<sup>89</sup>、<sup>90</sup>、<sup>91</sup>、<sup>92</sup>、<sup>93</sup>、<sup>94</sup>、<sup>95</sup>、<sup>96</sup>、<sup>97</sup>、<sup>98</sup>、<sup>99</sup>、<sup>100</sup>、<sup>101</sup>、<sup>102</sup>、<sup>103</sup>、<sup>104</sup>、<sup>105</sup>、<sup>106</sup>、<sup>107</sup>、<sup>108</sup>、<sup>109</sup>、<sup>110</sup>、<sup>111</sup>、<sup>112</sup>、<sup>113</sup>、<sup>114</sup>、<sup>115</sup>、<sup>116</sup>、<sup>117</sup>、<sup>118</sup>、<sup>119</sup>、<sup>120</sup>、<sup>121</sup>、<sup>122</sup>、<sup>123</sup>、<sup>124</sup>、<sup>125</sup>、<sup>126</sup>、<sup>127</sup>、<sup>128</sup>、<sup>129</sup>、<sup>130</sup>、<sup>131</sup>、<sup>132</sup>、<sup>133</sup>、<sup>134</sup>、<sup>135</sup>、<sup>136</sup>、<sup>137</sup>、<sup>138</sup>、<sup>139</sup>、<sup>140</sup>、<sup>141</sup>、<sup>142</sup>、<sup>143</sup>、<sup>144</sup>、<sup>145</sup>、<sup>146</sup>、<sup>147</sup>、<sup>148</sup>、<sup>149</sup>、<sup>150</sup>、<sup>151</sup>、<sup>152</sup>、<sup>153</sup>、<sup>154</sup>、<sup>155</sup>、<sup>156</sup>、<sup>157</sup>、<sup>158</sup>、<sup>159</sup>、<sup>160</sup>、<sup>161</sup>、<sup>162</sup>、<sup>163</sup>、<sup>164</sup>、<sup>165</sup>、<sup>166</sup>、<sup>167</sup>、<sup>168</sup>、<sup>169</sup>、<sup>170</sup>、<sup>171</sup>、<sup>172</sup>、<sup>173</sup>、<sup>174</sup>、<sup>175</sup>、<sup>176</sup>、<sup>177</sup>、<sup>178</sup>、<sup>179</sup>、<sup>180</sup>、<sup>181</sup>、<sup>182</sup>、<sup>183</sup>、<sup>184</sup>、<sup>185</sup>、<sup>186</sup>、<sup>187</sup>、<sup>188</sup>、<sup>189</sup>、<sup>190</sup>、<sup>191</sup>、<sup>192</sup>、<sup>193</sup>、<sup>194</sup>、<sup>195</sup>、<sup>196</sup>、<sup>197</sup>、<sup>198</sup>、<sup>199</sup>、<sup>200</sup>、<sup>201</sup>、<sup>202</sup>、<sup>203</sup>、<sup>204</sup>、<sup>205</sup>、<sup>206</sup>、<sup>207</sup>、<sup>208</sup>、<sup>209</sup>、<sup>210</sup>、<sup>211</sup>、<sup>212</sup>、<sup>213</sup>、<sup>214</sup>、<sup>215</sup>、<sup>216</sup>、<sup>217</sup>、<sup>218</sup>、<sup>219</sup>、<sup>220</sup>、<sup>221</sup>、<sup>222</sup>、<sup>223</sup>、<sup>224</sup>、<sup>225</sup>、<sup>226</sup>、<sup>227</sup>、<sup>228</sup>、<sup>229</sup>、<sup>230</sup>、<sup>231</sup>、<sup>232</sup>、<sup>233</sup>、<sup>234</sup>、<sup>235</sup>、<sup>236</sup>、<sup>237</sup>、<sup>238</sup>、<sup>239</sup>、<sup>240</sup>、<sup>241</sup>、<sup>242</sup>、<sup>243</sup>、<sup>244</sup>、<sup>245</sup>、<sup>246</sup>、<sup>247</sup>、<sup>248</sup>、<sup>249</sup>、<sup>250</sup>、<sup>251</sup>、<sup>252</sup>、<sup>253</sup>、<sup>254</sup>、<sup>255</sup>、<sup>256</sup>、<sup>257</sup>、<sup>258</sup>、<sup>259</sup>、<sup>260</sup>、<sup>261</sup>、<sup>262</sup>、<sup>263</sup>、<sup>264</sup>、<sup>265</sup>、<sup>266</sup>、<sup>267</sup>、<sup>268</sup>、<sup>269</sup>、<sup>270</sup>、<sup>271</sup>、<sup>272</sup>、<sup>273</sup>、<sup>274</sup>、<sup>275</sup>、<sup>276</sup>、<sup>277</sup>、<sup>278</sup>、<sup>279</sup>、<sup>280</sup>、<sup>281</sup>、<sup>282</sup>、<sup>283</sup>、<sup>284</sup>、<sup>285</sup>、<sup>286</sup>、<sup>287</sup>、<sup>288</sup>、<sup>289</sup>、<sup>290</sup>、<sup>291</sup>、<sup>292</sup>、<sup>293</sup>、<sup>294</sup>、<sup>295</sup>、<sup>296</sup>、<sup>297</sup>、<sup>298</sup>、<sup>299</sup>、<sup>300</sup>、<sup>301</sup>、<sup>302</sup>、<sup>303</sup>、<sup>304</sup>、<sup>305</sup>、<sup>306</sup>、<sup>307</sup>、<sup>308</sup>、<sup>309</sup>、<sup>310</sup>、<sup>311</sup>、<sup>312</sup>、<sup>313</sup>、<sup>314</sup>、<sup>315</sup>、<sup>316</sup>、<sup>317</sup>、<sup>318</sup>、<sup>319</sup>、<sup>320</sup>、<sup>321</sup>、<sup>322</sup>、<sup>323</sup>、<sup>324</sup>、<sup>325</sup>、<sup>326</sup>、<sup>327</sup>、<sup>328</sup>、<sup>329</sup>、<sup>330</sup>、<sup>331</sup>、<sup>332</sup>、<sup>333</sup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up>667</sup>、<sup>668</sup>、<sup>669</sup>、<sup>670</sup>、<sup>671</sup>、<sup>672</sup>、<sup>673</sup>、<sup>674</sup>、<sup>675</sup>、<sup>676</sup>、<sup>677</sup>、<sup>678</sup>、<sup>679</sup>、<sup>680</sup>、<sup>681</sup>、<sup>682</sup>、<sup>683</sup>、<sup>684</sup>、<sup>685</sup>、<sup>686</sup>、<sup>687</sup>、<sup>688</sup>、<sup>689</sup>、<sup>690</sup>、<sup>691</sup>、<sup>692</sup>、<sup>693</sup>、<sup>694</sup>、<sup>695</sup>、<sup>696</sup>、<sup>697</sup>、<sup>698</sup>、<sup>699</sup>、<sup>700</sup>、<sup>701</sup>、<sup>702</sup>、<sup>703</sup>、<sup>704</sup>、<sup>705</sup>、<sup>706</sup>、<sup>707</sup>、<sup>708</sup>、<sup>709</sup>、<sup>710</sup>、<sup>711</sup>、<sup>712</sup>、<sup>713</sup>、<sup>714</sup>、<sup>715</sup>、<sup>716</sup>、<sup>717</sup>、<sup>718</sup>、<sup>719</sup>、<sup>720</sup>、<sup>721</sup>、<sup>722</sup>、<sup>723</sup>、<sup>724</sup>、<sup>725</sup>、<sup>726</sup>、<sup>727</sup>、<sup>728</sup>、<sup>729</sup>、<sup>730</sup>、<sup>731</sup>、<sup>732</sup>、<sup>733</sup>、<sup>734</sup>、<sup>735</sup>、<sup>736</sup>、<sup>737</sup>、<sup>738</sup>、<sup>739</sup>、<sup>740</sup>、<sup>741</sup>、<sup>742</sup>、<sup>743</sup>、<sup>744</sup>、<sup>745</sup>、<sup>746</sup>、<sup>747</sup>、<sup>748</sup>、<sup>749</sup>、<sup>750</sup>、<sup>751</sup>、<sup>752</sup>、<sup>753</sup>、<sup>754</sup>、<sup>755</sup>、<sup>756</sup>、<sup>757</sup>、<sup>758</sup>、<sup>759</sup>、<sup>760</sup>、<sup>761</sup>、<sup>762</sup>、<sup>763</sup>、<sup>764</sup>、<sup>765</sup>、<sup>766</sup>、<sup>767</sup>、<sup>768</sup>、<sup>769</sup>、<sup>770</sup>、<sup>771</sup>、<sup>772</sup>、<sup>773</sup>、<sup>774</sup>、<sup>775</sup>、<sup>776</sup>、<sup>777</sup>、<sup>778</sup>、<sup>779</sup>、<sup>780</sup>、<sup>781</sup>、<sup>782</sup>、<sup>783</sup>、<sup>784</sup>、<sup>785</sup>、<sup>786</sup>、<sup>787</sup>、<sup>788</sup>、<sup>789</sup>、<sup>790</sup>、<sup>791</sup>、<sup>792</sup>、<sup>793</sup>、<sup>794</sup>、<sup>795</sup>、<sup>796</sup>、<sup>797</sup>、<sup>798</sup>、<sup>799</sup>、<sup>800</sup>、<sup>801</sup>、<sup>802</sup>、<sup>803</sup>、<sup>804</sup>、<sup>805</sup>、<sup>806</sup>、<sup>807</sup>、<sup>808</sup>、<sup>809</sup>、<sup>810</sup>、<sup>811</sup>、<sup>812</sup>、<sup>813</sup>、<sup>814</sup>、<sup>815</sup>、<sup>816</sup>、<sup>817</sup>、<sup>818</sup>、<sup>819</sup>、<sup>820</sup>、<sup>821</sup>、<sup>822</sup>、<sup>823</sup>、<sup>824</sup>、<sup>825</sup>、<sup>826</sup>、<sup>827</sup>、<sup>828</sup>、<sup>829</sup>、<sup>830</sup>、<sup>831</sup>、<sup>832</sup>、<sup>833</sup>、<sup>834</sup>、<sup>835</sup>、<sup>836</sup>、<sup>837</sup>、<sup>838</sup>、<sup>839</sup>、<sup>840</sup>、<sup>841</sup>、<sup>842</sup>、<sup>843</sup>、<sup>844</sup>、<sup>845</sup>、<sup>846</sup>、<sup>847</sup>、<sup>848</sup>、<sup>849</sup>、<sup>850</sup>、<sup>851</sup>、<sup>852</sup>、<sup>853</sup>、<sup>854</sup>、<sup>855</sup>、<sup>856</sup>、<sup>857</sup>、<sup>858</sup>、<sup>859</sup>、<sup>860</sup>、<sup>861</sup>、<sup>862</sup>、<sup>863</sup>、<sup>864</sup>、<sup>865</sup>、<sup>866</sup>、<sup>867</sup>、<sup>868</sup>、<sup>869</sup>、<sup>870</sup>、<sup>871</sup>、<sup>872</sup>、<sup>873</sup>、<sup>874</sup>、<sup>875</sup>、<sup>876</sup>、<sup>877</sup>、<sup>878</sup>、<sup>879</sup>、<sup>880</sup>、<sup>881</sup>、<sup>882</sup>、<sup>883</sup>、<sup>884</sup>、<sup>885</sup>、<sup>886</sup>、<sup>887</sup>、<sup>888</sup>、<sup>889</sup>、<sup>890</sup>、<sup>891</sup>、<sup>892</sup>、<sup>893</sup>、<sup>894</sup>、<sup>895</sup>、<sup>896</sup>、<sup>897</sup>、<sup>898</sup>、<sup>899</sup>、<sup>900</sup>、<sup>901</sup>、<sup>902</sup>、<sup>903</sup>、<sup>904</sup>、<sup>905</sup>、<sup>906</sup>、<sup>907</sup>、<sup>908</sup>、<sup>909</sup>、<sup>910</sup>、<sup>911</sup>、<sup>912</sup>、<sup>913</sup>、<sup>914</sup>、<sup>915</sup>、<sup>916</sup>、<sup>917</sup>、<sup>918</sup>、<sup>919</sup>、<sup>920</sup>、<sup>921</sup>、<sup>922</sup>、<sup>923</sup>、<sup>924</sup>、<sup>925</sup>、<sup>926</sup>、<sup>927</sup>、<sup>928</sup>、<sup>929</sup>、<sup>930</sup>、<sup>931</sup>、<sup>932</sup>、<sup>933</sup>、<sup>934</sup>、<sup>935</sup>、<sup>936</sup>、<sup>937</sup>、<sup>938</sup>、<sup>939</sup>、<sup>940</sup>、<sup>941</sup>、<sup>942</sup>、<sup>943</sup>、<sup>944</sup>、<sup>945</sup>、<sup>946</sup>、<sup>947</sup>、<sup>948</sup>、<sup>949</sup>、<sup>950</sup>、<sup>951</sup>、<sup>952</sup>、<sup>953</sup>、<sup>954</sup>、<sup>955</sup>、<sup>956</sup>、<sup>957</sup>、<sup>958</sup>、<sup>959</sup>、<sup>960</sup>、<sup>961</sup>、<sup>962</sup>、<sup>963</sup>、<sup>964</sup>、<sup>965</sup>、<sup>966</sup>、<sup>967</sup>、<sup>968</sup>、<sup>969</sup>、<sup>970</sup>、<sup>971</sup>、<sup>972</sup>、<sup>973</sup>、<sup>974</sup>、<sup>975</sup>、<sup>976</sup>、<sup>977</sup>、<sup>978</sup>、<sup>979</sup>、<sup>980</sup>、<sup>981</sup>、<sup>982</sup>、<sup>983</sup>、<sup>984</sup>、<sup>985</sup>、<sup>986</sup>、<sup>987</sup>、<sup>988</sup>、<sup>989</sup>、<sup>990</sup>、<sup>991</sup>、<sup>992</sup>、<sup>993</sup>、<sup>994</sup>、<sup>995</sup>、<sup>996</sup>、<sup>997</sup>、<sup>998</sup>、<sup>999</sup>、<sup>1000</sup>、<sup>1001</sup>、<sup>1002</sup>、<sup>1003</sup>、<sup>1004</sup>、<sup>1005</sup>、<sup>1006</sup>、<sup>1007</sup>、<sup>1008</sup>、<sup>1009</sup>、<sup>1010</sup>、<sup>1011</sup>、<sup>1012</sup>、<sup>1013</sup>、<sup>1014</sup>、<sup>1015</sup>、<sup>1016</sup>、<sup>1017</sup>、<sup>1018</sup>、<sup>1019</sup>、<sup>1020</sup>、<sup>1021</sup>、<sup>1022</sup>、<sup>1023</sup>、<sup>1024</sup>、<sup>1025</sup>、<sup>1026</sup>、<sup>1027</sup>、<sup>1028</sup>、<sup>1029</sup>、<sup>1030</sup>、<sup>1031</sup>、<sup>1032</sup>、<sup>1033</sup>、<sup>1034</sup>、<sup>1035</sup>、<sup>1036</sup>、<sup>1037</sup>、<sup>1038</sup>、<sup>1039</sup>、<sup>1040</sup>、<sup>1041</sup>、<sup>1042</sup>、<sup>1043</sup>、<sup>1044</sup>、<sup>1045</sup>、<sup>1046</sup>、<sup>1047</sup>、<sup>1048</sup>、<sup>1049</sup>、<sup>1050</sup>、<sup>1051</sup>、<sup>1052</sup>、<sup>1053</sup>、<sup>1054</sup>、<sup>1055</sup>、<sup>1056</sup>、<sup>1057</sup>、<sup>1058</sup>、<sup>1059</sup>、<sup>1060</sup>、<sup>1061</sup>、<sup>1062</sup>、<sup>1063</sup>、<sup>1064</sup>、<sup>1065</sup>、<sup>1066</sup>、<sup>1067</sup>、<sup>1068</sup>、<sup>1069</sup>、<sup>1070</sup>、<sup>1071</sup>、<sup>1072</sup>、<sup>1073</sup>、<sup>1074</sup>、<sup>1075</sup>、<sup>1076</sup>、<sup>1077</sup>、<sup>1078</sup>、<sup>1079</sup>、<sup>1080</sup>、<sup>1081</sup>、<sup>1082</sup>、<sup>1083</sup>、<sup>1084</sup>、<sup>1085</sup>、<sup>1086</sup>、<sup>1087</sup>、<sup>1088</sup>、<sup>1089</sup>、<sup>1090</sup>、<

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沈み込むように構成されている。前記ゲル材料46は、ベース材47の凹部に入れられており、このベース材47は、前記回路基板41を支持している構造である。なお、説明の便宜上、液晶層は図示していない。

【0010】(3)の特開平11-64860号公報にかかる反射型液晶表示素子50は、図8の説明図に示す如く、パッケージ本体51に取付けられる、第1の基板52、第2の基板53等よりなる反射型液晶パネル54の背面側に、金属製放熱板55が4辺を埋設した状態で設置され、前記反射型液晶パネル54と前記金属製放熱板55との間には比較的弾性を有する放熱シート56を介在させた構成である。そして、前記パッケージ本体51は、前記した反射型液晶パネル54背面側に設けられた金属製放熱板55と前面のガラス板57で密閉するキャビティ構造になっている。なお、説明の便宜上、液晶層は図示していない。

【0011】

【発明が解決しようとする課題】ところで、プロジェクションディスプレイ用の基幹部品である反射型液晶表示素子においては、機械的応力、熱的応力により画像表示品質の劣化が発生しないという必要性はもとより、近年、液晶表示素子に求められている低価格化の要請に応えるための構成部品価格及び構成部品点数の低減化が必要となる。

【0012】しかしながら、前記した(1)の特開平10-20234号公報にかかる反射型液晶表示素子30の場合は、反射型液晶パネル36の背面に接触する部分が無く、接着剤35を介して直接的に回路基板31に接着されている構成のため、外的な機械応力を受けにくい反面、反射型液晶パネル36からの放熱効率が悪く、しかも、前記反射型液晶パネル36に照射された光量により、この反射型液晶パネル36自身の温度が上昇し、各構成部品間の熱膨張率差によって図示しない液晶層のセルギャップが変化しやすいという課題を有している。

【0013】また、(2)の特表2001-500633号公報にかかる反射型液晶表示素子40の場合は、ベース材47の凹部に設けられた放熱ゲル剤46に、反射型液晶パネル45の一部を構成している第2の基板44を沈み込ませている構造のため、放熱効率が良く、かつ、放熱ゲル剤46が弾性を有するため外的な機械応力を受けにくいという良い面を持つてはいるが、ベース材47、回路基板41、反射型液晶パネル45の3つの構成部材間での接着支持が必要となるため、生産性が悪いという課題を有している。

【0014】更に、(3)の特開平11-64860号公報にかかる反射型液晶表示素子50の場合は、液晶パネル55と金属放熱板56との間に放熱シート57を介して放熱効率を上げているものであるが、パッケージ構成が複雑で、しかもキャビティ内を気密に保たねばならないので、生産性が悪く、前記した液晶表示素子を求

められている部品価格の低減化が困難ににくいという課題がある。

【0015】本発明は、かかる課題に鑑みなされたものであり、反射型液晶表示セルを冷却及び固定の機能を有するプレートのみにより支持するよう構成したことにより、外的な機械応力や熱応力による画像品質劣化の問題点及び生産性に関する問題点をも同時に解決したものであり、かかる構成を有する反射型液晶表示素子を提供することを目的とするものである。また、併せてかかる構成を有する反射型液晶表示素子の新規な製造方法を提供することを目的とするものである。

【0016】

【課題を解決するための手段】本発明は、前記した目的を達成するためになされたものであり、請求項1に係る発明は、シリコンウエハー基板4と透明基板2と前記両基板間に封止された液晶層5からなる反射型液晶表示セル10と前記反射型液晶表示セル10を冷却及び固定するプレート11とからなる反射型液晶表示素子20であって前記冷却及び固定のためのプレート11と反射型液晶表示セル10との隙間が50μm～500μmで、かつ、0.5W/m·k以上の熱伝導率を有するシリコーンゲル剤12及び50μm～500μmの厚さの接着剤13によってそれぞれ固着されている事を特徴とする。

【0017】請求項2に係る発明は、シリコンウエハー基板4と透明基板2と前記両基板間に封止された液晶層5からなる反射型液晶表示セル10と、前記反射型液晶表示セル10を冷却及び固定するプレート11とからなる反射型液晶表示素子20の製造方法であって、位置決め構造2.2、2.3を有する台座2.1上に、フイン構造1.1a～1.1n及び位置決め構造1.81、1.82を有するプレート1.1を位置決めし、前記プレート1.1上の前記反射型液晶表示セル10のシリコンウエハー基板4裏面に接触する部位にシリコーンゲル剤12を塗付し、かつ、前記プレート1.1上の透明基板2を受ける部位に接着剤13を塗布する工程と、前記反射型液晶表示セル10とプレート1.1との隙間を、前記シリコーンゲル剤塗布部、接着剤塗付部のそれぞれにおいてマニピュレータ2.6にて50μm～500μmに保つ工程と、前記接着剤13を硬化させる工程と、前記シリコーンゲル剤12を固着させる工程とからなることを特徴とする。

【0018】

【発明の実施の形態】以下、本発明の好適な一実施例を添付図面に基づいて説明する。なお、以下に述べる実施例は本発明の好適な具体例であるから、技術的に好ましい種々の限定が付されているが、本発明の範囲は、以下の説明において特に本発明を限定する旨の記載がない限り、これらの態様に限られるものではない。

【0019】図1は、本実施例に係る反射型液晶表示素子の主要部である反射型液晶表示セルの一実施例の分解斜視図、図2は、図1の構成説明図、図3は、本発明に

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係る反射型液晶表示素子の説明図、図4は、本発明に係る反射型液晶表示素子の構成部分であるプレートの説明図であり、(a)はその平面図、(b)はその側面図、図5は、本発明に係る反射型液晶表示素子の製造方法を示す工程図である。

【0020】図1に示すように、本実施例になる反射型液晶表示セル10は、透明電極1と反射防止膜8が施された透明基板2と、画素電極3や図示していない駆動用CMOSトランジスター等が半導体プロセスによって施されているシリコンウエハー(IC)基板4とが貼合わされた構造になっている。

【0021】図2は、図1の反射型液晶表示セル10の完成状態を示す構成説明図である。前記した2枚の基板2、4の間には液晶層5が設けられ、この2枚の基板2、4は、液晶層5のセルギャップを決めるスペーサ6を混入したシール接着剤7で固着されている。液晶層5の2枚の基板2、4との接触面には、図示していない配向膜が施されている。この実施例の場合は、透明基板2としてコーニング社製#1737ガラス基板を用い、透明電極1は、ITO(Indium Tin Oxide)膜、配向膜としては、酸化珪素膜をしたものである。

【0022】また液晶層5を構成する液晶としては、n型のネマチック液晶を用いた。シール接着剤7としては、協立化学産業(株)製WRシリーズメインシール剤にヤクシ化成(株)製SW-3、2D1スペーサボールを混入して紫外線照射及び加熱によって固着した。このようにして作製した反射型液晶表示セル10を動作時に冷却する方法として、図3及び図4に示す構造を採用了。

【0023】すなわち、図3及び図4において、冷却フィン11a～11nを有するプレート11上に、シリコーンゲル剤12を塗付し、かつ、前記反射型液晶表示セル10のガラス基板2とプレート11との接触面には、UV接着剤13を塗布する。シリコーンゲル剤12及びUV接着剤13の硬化後の厚さは、50μm～500μmであり、好ましくは50μm～300μmである。

【0024】シリコーンゲル剤12の熱伝導率は、0.5W/m·k以上が好ましく、GE東芝シリコーン(株)製の高熱伝導性シリコーンゲルや東レダウコーニングシリコーン(株)製の放熱用シリコーンゲルSEシリーズが好適である。ここでは、0.6W/m·kの熱伝導率を有するGE東芝シリコーン(株)製の高熱伝導性シリコーンゲルTSEシリーズを用いた。

【0025】UV接着剤13は、製造時に前記シリコーンゲル剤12が硬化するまでの間、前記反射型液晶表示セル10とプレート11との間の位置決めを保持するものであるため、位置決めを保持し、かつ、前記反射型液晶表示セル10に機械的応力を付与しない、比較的弹性を有する材料であれば、UV接着剤13に限定するもの

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ではない。ここでは、ケミテック(株)製の紫外線硬化性樹脂ケミシールを用いた。

【0026】プレート11としては、シリコーンゲル剤12を介して前記反射型液晶表示セル10の熱量を放熱するものであることから、シリコーンゲル剤12より高い熱伝導率を有する材料が望ましい。ここでは、アルミニウム材を用いた。アルミニウムの熱伝導率は約238W/m·kであるため、充分な放熱効果が得られるものである。なお、14は、窓材(アーチャ)である。

【0027】また、図4において、15は、前記したシリコーンゲル剤12が設けられる底面部、16は、前記したUV接着剤13が設けられる中間部、17は、前記したアーチャ14が設けられる上面部である。181、182は、後述する位置決めピン22、23が挿入される位置決め穴、191～194は、後述する反射型液晶表示素子20をプロジェクタ光学系の光学部品等に固定するためのネジ穴である。

【0028】次に、このようにして形成された本実施例になる反射型液晶表示素子20の実験結果について説明する。まず、前記反射型液晶表示セル10のガラス基板2とプレート11との間に、UV接着剤13を50μm以上の厚さで4箇所塗布した後、このUV接着剤13を紫外線照射で硬化させ、かつ、シリコンウエハー(IC)基板4とプレート11との間には、シリコーンゲル剤12を介さない(空気層:熱伝導率0.02W/m·k)場合には、70℃の高温環境下で画像上にガラスの複屈折発現によるムラが生じた。

【0029】一方、前記と同様、前記反射型液晶表示セル10のガラス基板2とプレート11との間に、UV接着剤13を50μm以上の厚さで4箇所塗布した後、このUV接着剤13を紫外線照射で硬化させ、かつ、シリコンウエハー(IC)基板4とプレート11との間にシリコーンゲル剤12を50μm以上の厚さで介在させた場合は、70℃の高温環境下であっても画像上のムラは全く観察されず、また、セルギャップ変化も発生しなかった。特に、50μm～300μmの厚さにおいて良好であった。さらに、1500ANSIルーメン相当のプロジェクター光学系に搭載した場合も、画像上のムラや表示画像品質の劣化は全く起こらなかった。

【0030】なお、前記反射型液晶表示セル10のガラス基板2とプレート11との間に、UV接着剤13を20μmの厚さで4箇所塗布した後、このUV接着剤13を紫外線照射で硬化させ、かつ、シリコンウエハー(IC)基板4とプレート11との間にシリコーンゲル剤12を20μmの厚さで介在させた場合には、室温環境下、すなわち初期状態で画像上にガラスの複屈折発現によるムラが生じた。このことより、シリコーンゲル剤12及びUV接着剤13の厚みは、50μm以上必要であることが理解できる。

【0031】前記したシリコーンゲル剤12及びUV接

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着剤13の厚みは、次の3点に鑑みて決めたものである。すなわち、(1)熱抵抗を考慮すると、厚みに比例して大きくなるため500μmを上限とすると良好な放熱効果が得られる。(2)後述するようなプレート11の製造工程(押出し成型の場合)において、前記反射型液晶表示セル10を受ける面の平坦度にバラつき(200μm程度)が生じる可能性を考慮して、その平坦度のバラつきを吸収する。(3)厚みの上限を500μmに設定することにより、反射型液晶表示セル10がその面内方向に力が加わっても許容範囲内の位置変化に抑えられる。

【0032】なお当然の如く、熱抵抗は、材料の厚さに比例するので、それが厚くなれば厚くなるほど放熱特性は悪化する。また、平面方向の荷重に対する位置変化は、やはり、材料の厚さに比例するので、それが厚くなれば厚くなるほど外的な荷重に対してアーチャと反射型液晶表示素子20との位置関係がずれやすく良い結果が得られない。

【0033】すなわち本実施例になる反射型液晶表示素子20は、かかる如くにシリコーンゲル剤12及びUV接着剤13を構成配置したことにより、プロジェクターやプロジェクションTVセット内において強力な光照射及びそれによる温度上昇によっても、表示画像品質に劣化の無い良好な反射型液晶表示素子が得られるものである。

【0034】次に、図1～図5、主として図5を参照して、本実施例になる反射型液晶表示素子20の製造方法について説明する。なお、図5において、21は、前記した位置決めピン22、23を上面に有する台座、24はディスペンサ、25はCCDカメラ、26はマニピュレータ、27は紫外線照射ライトガイド、28はオープンである。

【0035】まず、始めに前記した位置決め孔181、182を有するプレート11を、上方より位置決めピン22、23に沿って挿入し、このプレート11を台座21上に固定する(a)。

【0036】次に、台座21上に位置決め固定されたプレート11上において、前記反射型液晶表示セル10のシリコンウエハー基板4の受け面にディスペンサ24によってシリコーンゲル剤12を塗付する。また、透明基板であるガラス基板2の受け面に数箇所前記したディスペンサ24によって紫外線硬化型接着剤13を塗布する(b)。

【0037】次に、前記したプレート11に設けた位置決め孔181、182の位置をCCDカメラ(センサー)25にて認識すると共に、前記反射型液晶表示セル10の画素部デザインパターン3を画像認識し、前記反射型液晶表示セル10をプレート11上に固定する位置を検出する(c)。

【0038】次に、マニピュレータ(保持アーム)26

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によって、前記反射型液晶表示セル10をプレート11上で所定の平面位置及び垂直方向位置に保持し、しかる後、前記反射型液晶表示セル10のシリコンウエハー基板4の底面とプレート11面との隙間を50μm～500μmに保つ。

【0039】次に、この隙間を保った状態で前記反射型液晶表示セル10のガラス基板2とプレート11との間に有するUV接着剤13に、UV照射用ライトガイド27により紫外線を照射してこれを硬化させる。この時点で前記反射型液晶表示セル10のプレート11上での位置が固定される(d)。

【0040】次に、再度CCDカメラ25にてアーチャ14のパターン認識を行い、先ほど検出したプレート11に設けられた位置決め孔181、182の位置との相対位置のそれぞれを決定して、窓材14をマニピュレータ26等で所定の位置にて保持する(e)。

【0041】しかる後、所望の位置に保持されたアーチャ14とプレート11との接触部近傍に、前記したディスペンサ24によってUV接着剤を塗布する(f)。

【0042】次に、塗付されたUV接着剤に紫外線照射用ライトガイド27により紫外線を照射して前記したUV接着剤を硬化させる(g)。

【0043】前記したアーチャ14とプレート11との接触部近傍にUV接着剤を塗布する工程(f)、塗付されたUV接着剤に紫外線照射用ライトガイド27により紫外線を照射して前記したUV接着剤を硬化させる工程(g)は、生産性の観点からUV紫外線にて速い硬化速度を望むものであるから、硬化速度の速い接着剤であればUV接着剤に限定するものではない。また窓材14には図示していない防塵用のスポンジ等を予め付与する場合もある。

【0044】以上の工程により、前記反射型液晶表示セル10とアーチャ14とがプレート11上に固定された状態のものをオープン28にて加熱し、シリコーンゲル剤12の硬化を促進させる(h)。加熱条件は、100℃～120℃にて30分～1時間程度が望ましい。

【0045】前記した時間加熱を行うことにより、反射型液晶表示素子20が完成する(i)。

【0046】以上の製法のうち、アーチャ14が不要な場合は、前記したアーチャ14をマニピュレータ26等で所定の位置にて保持する工程(e)～塗付されたUV接着剤13に紫外線照射用ライトガイド27により紫外線を照射して前記したUV接着剤13を硬化させる工程(g)を省略することができる。

【0047】また、前記した製造方法において、反射型液晶表示セルに設けられる図示しないフレキシブルプリント基板(FPC)を前記プレート11から隙間をもつて保持したままUV接着剤13にて固定する工程と、入射光及び表示画像を通過させるアーチャ14を前記プレート11上に設置してUV接着剤にて固定する工程と

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を付加することにより、より安定化したこの種反射型液晶表示素子が得られるものである。なお、これらの工程は、工程 (d) ~ 工程 (e) の間で行われるものであり、その場合の請求項は以下の通りであり、本発明は、これらの内容をも含むものである。

【0048】シリコンウエハー基板と透明基板と前記両基板間に封止された液晶層からなる反射型液晶表示セルと前記反射型液晶表示セルを冷却及び固定するプレートとからなる反射型液晶表示素子の製造方法であって、位置決め構造を有する台座上に、フィン構造及び位置決め構造を有するプレートを位置決めし、前記プレート上の前記反射型液晶表示セルのシリコンウエハー基板裏面に接触する部位にシリコーンゲル剤を塗付し、かつ前記プレート上の透明基板を受ける部位に接着剤を塗布する工程と、前記反射型液晶表示セルと前記プレートとの隙間を、シリコーンゲル剤塗布部、接着剤塗付部のそれぞれにおいてマニピュレータにて  $50 \mu\text{m} \sim 500 \mu\text{m}$  に保つ工程と、前記接着剤を硬化させる工程と、前記反射型液晶表示セルに設けられるフレキシブルプリント基板を前記プレートと隙間をもって保持したまま前記接着剤にて固着する工程と、入射光及び表示画像を通過させる窓材を前記プレート上に設置して前記接着剤にて固着する工程と、前記シリコーンゲル剤を固着させる工程とからなることを特徴とする反射型液晶表示素子の製造方法。

【0049】

【発明の効果】請求項 1 に係る発明は、シリコンウエハー基板と透明基板と前記両基板間に封止された液晶層からなる反射型液晶表示セルと前記反射型液晶表示セルを冷却及び固定するプレートとからなる反射型液晶表示素子であって、前記冷却及び固定のためのプレートと反射型液晶表示セルとの隙間が  $50 \mu\text{m} \sim 500 \mu\text{m}$  の厚さでかつ  $0.5 \text{ W/m} \cdot \text{k}$  以上の熱伝導率を有するシリコーンゲル剤及び  $50 \mu\text{m} \sim 500 \mu\text{m}$  の厚さの接着剤によってそれぞれ固着されているものであるから、高温環境下においてもセルギャップの変化が見られず、また通常ガラス基板に応力がかかる場合に生じる複屈折の発現によって生じるような画像上のムラも発生しないので、プロジェクター及びプロジェクション TV に用いた場合に良好な表示画像品質を保つことができるという効果が得られるものである。

【0050】また請求項 1 では、反射型液晶表示セルが、冷却及び固定の機能を有するプレートのみでシリコーンゲル剤、接着剤を介して支持されているため、部品点数が少なくてすみ、従って、甚だ生産性がよく、しかも安価で高品質な反射型液晶表示素子が得られるものである。

【0051】また請求項 1 では、シリコーンゲル剤が、 $0.5 \text{ W/m} \cdot \text{k}$  以上の熱伝導率及び  $50 \mu\text{m} \sim 500 \mu\text{m}$  の厚さを有するため、外的な機械応力や熱応力による画像品質劣化のおそれがなく、高品質な反射型液晶表

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示素子が得られるものである。

【0052】更に請求項 1 では、上述したようにシリコーンゲル剤が、 $0.5 \text{ W/m} \cdot \text{k}$  以上の熱伝導率及び  $50 \mu\text{m} \sim 500 \mu\text{m}$  の厚さを有するために、反射型液晶表示セルからの放熱効率が良好であり、外的な温度上昇による画像品質劣化のおそれがなく、高品質な反射型液晶表示素子が得られるものである。

【0053】請求項 2 に係る発明は、シリコンウエハー基板と透明基板と前記両基板間に封止された液晶層から

なる反射型液晶表示セルと、前記反射型液晶表示セルを冷却及び固定するプレートとからなる反射型液晶表示素子の製造方法であって、位置決め構造を有する台座上に、フィン構造及び位置決め構造を有するプレートを位置決めし、前記プレート上の前記反射型液晶表示セルのシリコンウエハー基板裏面に接触する部位にシリコーンゲル剤を塗付し、かつ、前記プレート上の透明基板を受ける部位に接着剤を塗布する工程と、前記反射型液晶表示セルとプレートとの隙間を、前記シリコーンゲル剤塗布部、接着剤塗付部のそれぞれにおいてマニピュレータにて  $50 \mu\text{m} \sim 500 \mu\text{m}$  に保つ工程と、前記接着剤を硬化させる工程と、前記シリコーンゲル剤を固着させる工程とからなるもの、すなわち、位置決めされたプレート上にシリコーンゲル剤と接着剤を塗布し、前記反射型液晶表示セルを保持したままシリコーンゲルを固着させる製造方法であるから、製造時には、組み立て部品は使用部品を下から積み上げていくという単純な工法を取ることができ、従って、製造時の組み立て装置の設計及び自動化が容易であり、高い生産性を保つことができるものである。

【0054】また請求項 2 では、フィン構造及び位置決め構造を有するプレートの構造を単純なものとしたので、プレート部品の製造に際し、たとえば金属または樹脂の押し出し成型が可能となるので、プレート部品の低価格化が可能となり、ひいては反射型液晶表示素子の低価格化に貢献できるものである。

【図面の簡単な説明】

【図 1】本発明に係る反射型液晶表示素子の主要部である反射型液晶表示セルの一実施例の分解斜視図である。

【図 2】図 1 の構成説明図である。

【図 3】本発明に係る反射型液晶表示素子の説明図である。

【図 4】本発明に係る反射型液晶表示素子の構成部分であるプレートの説明図である。

【図 5】本発明に係る反射型液晶表示素子の製造方法を示す工程図である。

【図 6】従来の反射型液晶表示素子の説明図である。

【図 7】従来の反射型液晶表示素子の説明図である。

【図 8】従来の反射型液晶表示素子の説明図である。

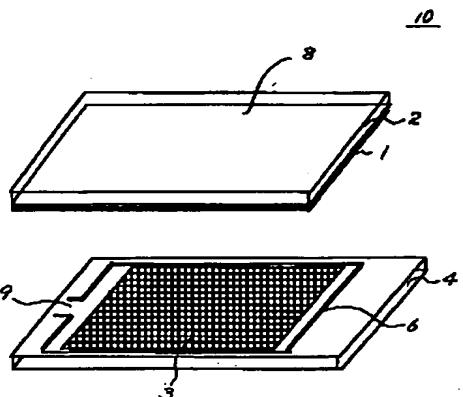
【符号の説明】

50 1 透明電極

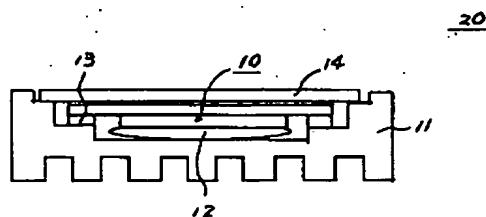
(7)

11  
 2 透明基板  
 3 画素電極  
 4 シリコンウエハー基板  
 5 液晶層  
 6 スペーサ  
 7 シール接着剤  
 8 反射防止膜  
 9 封止部  
 10 反射型液晶表示セル  
 11 プレート  
 12 シリコーンゲル剤  
 13 UV接着剤  
 14 アーチャ  
 15 底面部

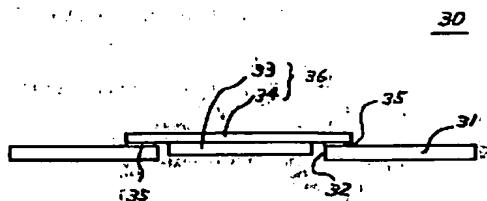
【図1】



【図3】



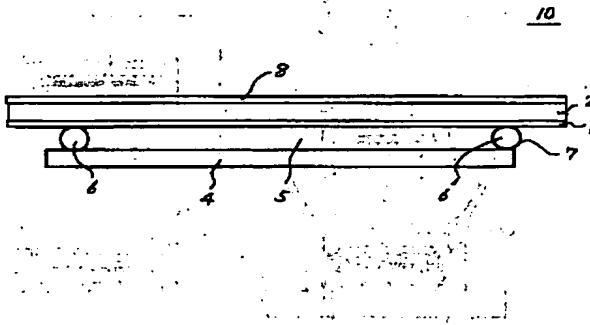
【図6】



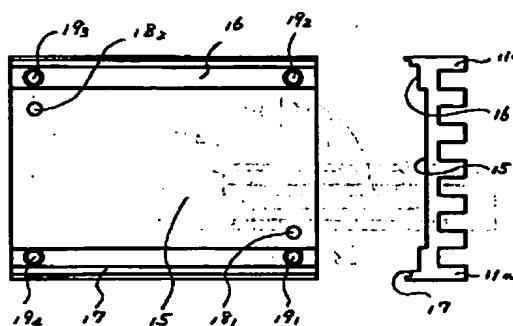
(7)

12  
 16 中間部  
 17 上面部  
 18 位置決め穴  
 19 反射型液晶表示素子固定穴  
 20 反射型液晶表示素子  
 21 固定台  
 22 位置決めピン  
 23 位置決めピン  
 24 ディスペンサ  
 25 CCDカメラ  
 26 マニピュレータ  
 27 紫外線照射ガイド  
 28 オープン

【図2】



【図4】

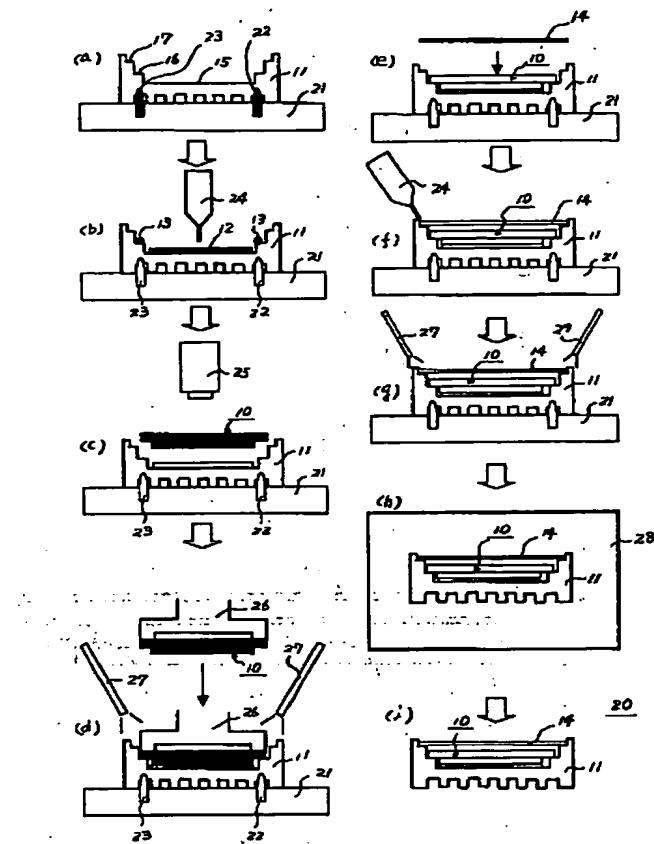


(a)

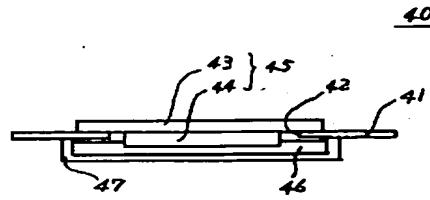
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(8)

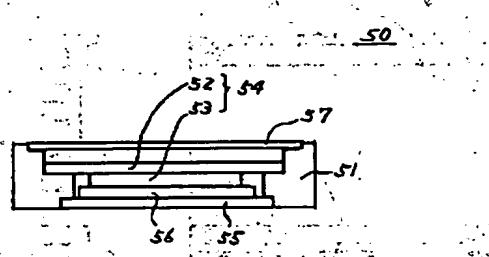
【図5】



【図7】



【図8】



フロントページの続き

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